

## CLAIMS

What is claimed is:

1. A metropolitan area packet network, comprising:  
a first ring for transporting packets in a clockwise direction;  
a second ring for transporting packets in a counter-clockwise direction;  
a plurality of network nodes coupled to the first ring and the second ring;  
a detector residing within each of the nodes which detects a failure in a segment of either of the first ring and second ring;  
a switch-over circuit residing within one of the nodes which switches data packets from one ring having a detected failed segment to another ring.
2. The metropolitan area network of Claim 1, wherein a node from where a data packet originates performs a switch-over when the failure is detected.
3. The metropolitan area network of Claim 1, wherein a node accepts a data packet from the first ring and transfers the data packet out on the second ring in response to the failure.
4. The metropolitan area network of Claim 1, wherein the first ring and the second ring comprise a bi-directional flow-switched ring.

5. The metropolitan area network of Claim 1, wherein data packets are routed on a per-flow basis.

6. The metropolitan area network of Claim 1, wherein data packets are switched over from one ring to another ring in response as a function of congestion on a particular ring segment.

7. The metropolitan area network of Claim 1, wherein different degrees of protection are enabled.

8. The metropolitan are network of Claim 1, wherein a unicast flow having a destination before a failed node is not redirected by keeping the flow in the first ring and a unicast flow having a destination after a failed node is protected by redirecting that flow onto the second ring.

9. The metropolitan area network of Claim 1, wherein a multicast flow is redirected by:

keeping the multicast flow on the first ring if all destinations occur before a failed node;

redirecting the multicast flow onto the second ring if all destinations occur after the failed node;

keeping the multicast flow on the first ring and copying the multicast flow onto the second ring if destinations occur both before and behind the failed node.

10. The metropolitan area network of Claim 1, wherein at least one of the network nodes performs packet bleeding to prevent out-of-order packet arrival at a destination node when flows are restored back to their primary ring.

11. In a network having at least two packet rings and a plurality of switching devices coupled to the two packet rings, a method of transmitting packets between the switching devices, comprising the steps of:

transmitting packets in a clockwise direction in a first ring;

transmitting packets in a counter-clockwise direction in a second ring;

detecting when a failure has occurred in a segment of either of the first ring or the second ring;

switching a packet to an operational ring in response to detection of the failure.

12. The method of Claim 11 further comprising the step of the switching device immediately switching an originating packet to the operational ring when the failure is detected.

13. The method of Claim 11 further comprising the steps of:

accepting the packet from an upstream switching device;

transferring the packet from the first ring for output on the second ring in response to a failure detected on the first ring.

14. The method of Claim 12, wherein the first ring and the second ring comprise a bi-directional flow-switched ring.

15. The method of Claim 11, wherein data packets are routed on a per-flow basis.

16. The method of Claim 11, wherein data packets are switched over from one ring to another ring in response as a function of congestion on a particular ring segment.

17. The method of Claim 11, wherein different degrees of protection are enabled.

18. The method of Claim 11 further comprising the steps of:  
keeping the unicast flow in the first ring;

redirecting a unicast flow having a destination after the failed node by  
redirecting that flow onto the second ring.

19. The method of Claim 11 further comprising the step of re-directing a multicast flow:

keeping the multicast flow on the first ring if all destinations occur  
before a failed node;

redirecting the multicast flow onto the second ring if all destinations  
occur after the failed node;

keeping the multicast flow on the first ring and copying the multicast flow onto the second ring if destinations occur both before and behind the failed node.

20. The method of Claim 11 further comprising the step of performing packet bleeding to prevent out-of-order packet arrivals at a destination node when flows are restored back to their primary ring.

21. A metropolitan area packet network, comprising:  
a fiber optic ring for transporting packets, wherein the fiber ring comprises a plurality of lambdas;  
a plurality of network nodes coupled to the fiber optic ring;  
a detector residing within each of the nodes for detecting a failure;  
a switch residing within one of the nodes which redirects data packets from a first lambda to a second lambda if a failure corresponding to the first lambda is detected .